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RADIATION PROTECTION PROGRAM AT THE PADUCAH PLANT  
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I. GENERAL INFORMATION

The Paducah Plant, operated by UCNC and located at Paducah, Kentucky, is one of three gaseous diffusion plants of the Atomic Energy Commission for the separation of  $U^{235}$ , the fissionable isotope of uranium. The uranium compound used in this process, uranium hexafluoride, is manufactured from purified uranium trioxide obtained from natural uranium ore concentrates or from reprocessed spent reactor fuels. Uranium metal is also produced from uranium hexafluoride in a foundry.

The chemical toxicity rather than the radioactivity hazard is the primary consideration in the handling of the large quantities of uranium materials at this plant.

Of only secondary importance are the relatively minor hazards associated with the daughter products of uranium and from the minute traces of radioisotopes contained in purified uranium trioxide from reprocessed spent reactor fuels. Only very infrequent use is made of radioisotopes in tracer studies on plant problems.

A comprehensive description of the Paducah Plant radiation protection program is given in exhibit 1, KY-204, "Paducah Plant Health Physics Program." Administration of this program is carried out in the same manner as the administration of all basic policies of the Company, that is, by means of standard practice procedures. These procedures not only provide the basic regulations established for limiting exposure of plant personnel to safe levels, but also contain the administrative procedures by which the policies and regulations are carried out. It has been found that the use of a standard practice procedure manual, containing all Company policies requiring supervisory implementation, is one of the most effective means of ensuring uniform compliance with established standards. Copies of the pertinent standard practice procedures are contained in exhibits 2 through 11.

II. HAZARD SUMMARY

A. Plant Materials

The principal radioactive materials handled at Paducah are uranium compounds, usually in equilibrium with daughter products. These materials are found in all the various production facilities. Details of the origin of uranium contamination and the measures to control its potential hazard are described in KY-204, exhibit 1. Other minor sources of radiation include sealed or encapsulated radioisotopes or solutions of radioisotopes. Exhibit 10, Standard

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Practice Procedure 51, "Control of Radiation Sources and Radioactive Tracers," requires a physical inventory and monthly report of all sources and tracer material. Exhibit 12 shows a recent report of such sources and tracers. Physical data and information on biological effects of all these radioactive materials are readily available in the literature.

#### B. Maximum Permissible Limits

All plant limits and indices are based on principles and standards recommended by the National Committee on Radiation Protection and Measurements as published by the National Bureau of Standards or as specified by the Commission. Internal action points are set to allow additional margins of safety so that measures can be taken to prevent employee exposure from exceeding the MPD. These limits and action points are stated in exhibit 5 in Standard Practice Procedure 41, "Radiation Control," while the plant experience in maintaining employee exposure within the MPD is shown in KY-204, "Paducah Plant Health Physics Program."

The rationale employed in establishing special MPL's for clothing contamination, urinary excretion, etc., is the same as that developed at ORGDP. Referenced documents are included in the ORGDP exhibits. The Paducah Plant does not have as much a surface or area contamination problem as ORGDP since the uranium handled at Paducah does not present an alpha radiation problem but only a chemical toxicity problem. Experience has shown that customary good housekeeping practices will keep airborne activity arising from surfaces at Paducah to a negligible level.

### III. DESCRIPTIVE STATEMENT OF PROTECTION PROGRAM

#### A. On-Site Program

##### i. Plant Personnel Protection Program

It is plant policy to protect personnel from hazards inherent in handling radioactive materials. Every effort is made to prevent personnel exposure from exceeding radiation limits established by the NCRP and to keep employees having existing pathology from contact with these materials.

To implement this policy, standard practice procedures have been developed. As noted in Section I, the procedures form the basis for the administration of the radiation protection program for personnel at the Paducah Plant and are included as exhibits 2 through 11.

In addition to the standard practice procedures, a compilation of information concerning the effectiveness of the radiation protection program at Paducah is given in KY-204, exhibit 1. Also, a summary of the program is given in the Section 30.1, "Health Procedures," of report KY-56, Revision 2, SS Procedures Manual.

Much of the effectiveness of a personnel protection program depends upon the adequacy and thoroughness of the training of all employees. Maintenance, Operations, Laboratory and other personnel concerned with handling radioactive materials received formalized training in personnel protection against the hazards of radiation prior to the start-up of the plant. As new employees have been hired they also have received such orientation. Supplemental training has been accomplished through on-the-job training, safety meetings and through special instructional courses.

One of the recent training programs was a series of seminars held last year for all salaried employees. A copy of the training material used in these seminars, "Health Physics Training Manual," is included as exhibit 13. The material given during the seminars was also used to make a movie, "Uranium, Radiation and Us," which has been shown to all Paducah Plant employees.

By the activities of line supervision, by the services of various staff groups, by means of on-the-job training, and by periodic comprehensive educational programs, employees are made constantly aware of the necessity of careful adherence to plant standards and regulations on radiation protection.

## 2. Plant Environs Protection System

Details of the plant environs monitoring program are covered in the following documents and letters which are available to Commission personnel:

JCAE Hearings on Radioactive Waste Disposal statement on waste management at the Oak Ridge and Paducah production plants, included in a letter from L. B. Emlet to L. G. Struxness with copy to R. C. Armstrong, dated 1-19-59.

Letter from C. E. Center to S. R. Sapirie, "Environmental Monitoring Procedures," dated 1-21-58.

Letter from L. B. Emlet to S. R. Sapirie, "Information on Waste Disposal," dated 2-1-57.

#### B. Plant Perimeter and Off-Site Programs

The program for control and monitoring of on-site contamination also provides control of off-site contamination. Thus, the references listed in Section III.A.2 indicate the basis for control of off-site contamination. Additional information is contained in the letter from C. E. Center to S. R. Sapirie, "Radioactive Content of the Atmosphere and the Amount of Fallout," dated April 28, 1959.

The letter from C. E. Center to S. R. Sapirie, "Survey of AEC Regulations with State and Local Governments and Other Federal Agencies in Regulating Radiation Hazards," dated 10-28-58, contains information concerning the manner of coordination with off-site interests such as agencies of State and local governments.

#### IV. REPORTING

Radiation protection survey data are initiated by several operating departments as well as by the Health Physics and Hygiene Department. Much of these data are recorded on report forms designed specifically for this purpose; however, many reports are compiled without resorting to a standard form. Thus, periodic summary reports to management are internal memoranda which present recent data interpreted according to currently accepted standards. Health Physics audit reports, similarly, present to supervision specific information concerning radiation surveys of plant areas in a memorandum form. Such reports as investigation of high air samples and investigation of elevated film badge results present the following information: (1) Name of person or area involved, (2) Amount of high exposure or exposure condition, (3) Date of event, (4) Specific job or condition which produced the abnormal condition, (5) Recommendations for corrective action. A summary of pertinent reports that are presently being utilized at the Paducah Plant is presented in the following table.

##### PADUCAH PLANT RADIATION REPORTS

<u>Report Title</u>	<u>Exhibit No.</u>	<u>Originated By</u>	<u>Distributed To</u>
1. Radioactive Airborne Contamination	14A	Group Operating Area	Health Physics & Hygiene Dept.
2. Radioactivity Analysis Report	14B	Isotopic Lab.	Group which collected air samples

## PADUCAH PLANT RADIATION REPORTS, Cont'd.

<u>Report Title</u>	<u>Exhibit No.</u>	<u>Originated By</u>	<u>Distributed To</u>
3. Contamination and Radiation Status	14C	Group Operating Area	Health Physics & Hygiene Dept.
4. Health Physics Audit Report	*	Health Physics & Hygiene Dept.	Group Operating Area
5. Medical Restriction Report	14D	Medical Director	Division Superintendent
6. Quarterly Summary of Film Badge Results From Data Processing Group	*	Health Physics & Hygiene Dept.	Departmental Supervision
7. Investigation of Film Badge Results	*	Health Physics & Hygiene Dept.	Departmental Supervision
8. Investigation of High Air Samples	*	Health Physics & Hygiene Dept.	Departmental Supervision
9. SS Materials Tally-Out Sheet	14E	Uranium Control Department	Receiver
10. Reports to AEC in Accordance with AEC Chapter 0523	*	Plant Supt.	AEC
11. Periodic Summary Reports to Management	*	Health Physics & Hygiene Department	Appropriate Plant Supervision

\*No special form is used and therefore no exhibit is attached.

## V. ORGANIZATION AND COSTS OF PROGRAM

- A. The primary responsibility for the protection of personnel against radiation and other health hazards is placed on line supervision, who are guided by standard practice procedures and are aided by staff and service groups. These responsibilities are discussed in detail in KY-204, exhibit 1. Since the administration of radiation protection within operating groups is combined with other supervisory functions, this cost is not collected separately and can not be estimated accurately.

ately. The plant operating groups have radiation instruments which are used in normal operation and some groups operate and maintain continuous air samplers as a part of the plant air monitoring system. Again these costs are included in the departmental operating expense, but estimates have been made of these costs and are included in the table below.

The staff group providing radiation protection services also has industrial hygiene and nuclear safety responsibilities. These functions are also combined in environmental sampling and inspection in that the same sample may be analyzed for radioactivity and for toxic chemicals. These costs are collected separately and that charged to Health Physics is included as a part of the radiation protection costs.

#### ORGANIZATION AND COSTS FOR RADIATION PROTECTION

<u>Equivalent Job Title</u>	<u>Equivalent Personnel</u>	<u>Cost</u>	<u>Charged To</u>	<u>Work Performed By</u>
a. Employees of Staff Group				Health Physics and Hygiene Dept.
Supervision	1			
Health Physicists	2			
Technicians	2		Health Physics Dept.	
Clerical	<u>1</u>			
Total	6	\$44,000		
b. Service Groups				
Instrument Mechanics	1	\$ 8,000	Instrument User	Instrument Maint.
Laboratory Analysts	<u>1</u>	<u>\$ 8,000</u>	Staff and Operating Groups	Analytical & Counting Lab.
Total		\$16,000		

#### Notes

- These costs are operating costs and are estimated from FY-1959 experience and forecasts.
- The following types of costs are excluded from the list.
  - Capital costs.

- b. Bio-assay and other industrial hygiene measurements.
- c. Nuclear safety.
- d. Ventilation and confinement measures.
- e. Respirators and other protective equipment.
- f. Decontamination.

#### VI. DEVELOPMENT PROGRAM

The Paducah Plant does not maintain a development program, but only undertakes such activities as may be necessary from time to time in support of plant investigations or plant trouble shooting. Such activities are carried out by the appropriate plant groups including the support of the various service and staff organizations. Costs of such trouble shooting are normally borne by the operating group concerned.

The Paducah Plant utilizes information and equipment developed by Oak Ridge and by other AEC contractors as made available from their research and development programs.